

Bovine Demodecosis: Treat to Leather Industry in Ethiopia

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Abstract: A cross-sectional study was conducted commencing October 2010 to June 2011 in and around Gondar, Amhara Regional State, Ethiopia with the objectives of assessing the economic impact; determine prevalence and extent of hide damage. A total of 384 cattle of all age, sex and breed OF were examined and deep skin scrapings with pus and ten hides were sampled. SPSS version 19 was used for data analysis. Higher prevalence was observed in cross breeds 15.75% than local breeds, 15.55%. The highest prevalence was observed from animals greater than 3 years of age, 48 (18.32%) while the lowest, 9 (0.96%) in those one to three years. 18.25 and 11.1% was recorded in female and male animals respectively. The spatial distribution of demodex on shoulder was 8.08 and 1.04% on ears and eyes respectively. Production system of semi-intensive and extensive managements was found almost affecting similarly with 13.66 and 13.43%, respectively. In lime-sulphide treated hides large nodules were prominent with dark contents; small non-protruding nodules, enlarged openings and ragged depressions near the grain surface were depicted. In conclusion the highest overall prevalence (15.63%) of *D. bovis* infestation was recorded. This indicates that despite many efforts tried to study infectious diseases prevalence in the study area, demodicosis has been given lesser attention to be treated as a separate health problem. Therefore, Prevention and control measures should be taken rather than treating demodicosis.

Keywords: Bovine demodectic mange, gondar, prevalence, skin scraping

INTRODUCTION

Demodex bovis, the hair follicle mite, is found everywhere in the world. One or more species of *Demodex* mite are known to infest most species of mammals, including man. The microscopic, cigar shaped, worm-like parasites live in hair follicles and sebaceous glands, resulting in nodules within the skin. The injury they inflict, confined to the skin, is of primary concern only to the hide and leather industry and in show ring competition (Izdebska, 2009). If a fresh nodule is nicked with a sharp scalpel, a thick, tooth paste like pus can sometimes be expressed that contains masses of *D. bovis* mites, but older lesion consist only of scar tissue and are devoid of mites (Bowmann and Georgis, 2003; Matthes and Bukva, 1993).

Transmission usually occurs by direct contact from the dam to her offspring during nursing in the neonatal period and never between host animals of different species (Jubb *et al.*, 2007). This implies that the small numbers of mites exist in harmony with the host, and it is only when the equilibrium between the host and parasite is altered in favor of the mite that excessive proliferation occurs and lesions demodectic mange are produced. Increased numbers of mites are seen in animals

with a genetic predisposition or disorders of the immune system (Blagburn and Dryden, 2000).

Damages to skin affect the production of quality leather. Demodectic mange is not considered to be a major parasite of cattle but it may open the skin for secondary problems (bacterial and fungal infection, mastitis, and others) (Kaufmann, 1996).

In Ethiopia despite many efforts tried to study infectious diseases prevalence in the country, demodicosis has been given lesser attention to be treated as a separate health problem. There are no researches undertaken to address livestock demodicosis separately. This also holds true in and around Gondar except some efforts were done to assess canine demodicosis. Studying the existing problems of bovine demodicosis seems very crucial for improving livestock health, skin and hide quality. Therefore, the objective of this study is to assess the economic, determine the prevalence and extent of damage due to *D. bovis* in and around Gondar town.

MATERIALS AND METHODS

Study area: The study was conducted in and around Gondar town is located at 727 km Northwest of Addis

Ababa in Amhara National Regional State with an altitude 2220 m a.s.l, with 1172 mm mean annual rainfall and 19.7°C average annual temperatures. The rainfall varies from 880 mm to 1,772 mm with a monomodal distribution. The area is also characterized by two seasons; the wet season from June to September and the dry season from October to May. Its area is 257 km² (GAO, 2011; CSA, 2008).

Study animals: The sampling units of the study were cattle of different breed, age and sex that are found in and around Gondar town kept mainly under extensive traditional management system.

Sample size determination: The sample size required for this study was determined according to Thrusfield (2007). Since there was no similar study done previously on the study area, the expected prevalence was taken as 50%. Therefore, using 50% expected prevalence and 5% absolute precision at 95% confidence interval, the number of animals needed in this study were calculated to be 384. In addition to animal samples ten infected hides were used for examination of the extent of damage in the tannery processing and histopathologic aspects.

Study design and procedures: A cross-sectional study with simple random sampling techniques was used. History was taken from the animal owners about previous treatment, management, feeding and occurrence of skin diseases. Samples of deep skin scraping with pests of pus were collected, transported and processed in the veterinary parasitology laboratory in the faculty of veterinary medicine, university of Gondar. Then a direct smear of this material was examined under low power microscope.

Hide damage assesement: Ten infected hides from infected animals were labled at the time of slaughter then it was taken to the tannery and here the tannery stamped them for identification at the semi processed and processed level. Then the first examination of the hides was started after it has been un-haired. To facilitate the study of lesion light was used in examining the flesh and grain sides of the hide. To facilitate the lesion counts the surface of the hide was marked with carbon pencil into areas approximately one foot square. Areas corresponding to those marked on the hide were made on the outlines of a hide to scale and in such the number and lesions were recorded on each sample hide. After this and before semi processing and processing of hides the extent of damage was compared with the presence of demodectic lesions previously recorded. Ten hides were purposely selected and processed for histopathology as indicated by Bancroft and Harry (1994).

Data analysis: The data was first entered and managed in to Microsoft Excel worksheet and analyzed using Statistical Package for Social Sciences (SPSS) software version 19. The prevalence of demodectosis was expressed as percentage with 95% confidence interval by dividing the total number of cattle positive to demodectosis to the total number of animal examined in the study period. The prevalence rate of demodectosis was calculated for different risk factors as the number of demodectosis positive animals examined dividing by the total number of animals investigated at the particular time. The significant difference between the prevalence of demodectosis was determined using descriptive statistics; Chi-Square test (χ^2) where P- value id found less than 0.05.

RESULTS

Out of the 384 cattle examined in and around Gondar town, 60 (15.63%) were found positive for *Demodex bovis*. From these 238 were local breed and 146 were cross breed; 28 were less than one year, 94 were 1 to 3 years and 262 were greater than 3 years old were 143 male and 241 were female. There was no statistically significant difference observed between the two categories of breeds ($\chi^2 = 0.003$, $p > 0.05$) and the prevalence in cross breed cattle, 23 (15.75 %) and in local breeds was 37 (15.55 %) (Table 1).

Out of the total 384 cattle examined under different age categories, the highest prevalence of demodectosis was observed in greater than 3 years of age 48 (18.32%) while the lowest prevalence 9 (0.96%) was observed in those 1 to 3 years old (Table 1) although there was no statistically significant difference observed among the three age categories ($\chi^2 = 4.566$, $p > 0.05$).

There was a statistically significant variation detected between the two sex groups ($\chi^2 = 3.401$, $p < 0.05$) and the prevalence of bovine demodectosis was found in 44 (18.25%) female and in 16 (11.1 %) male animals.

Table 1: Age, sex, and breed were risk factors determining the prevalences of bovine demodectosis in Gondar.

Parameters	No of cattle examined	Prevalence	Chi-square	p-value
Age				
Less than one year	28	3 (10.71)	$\chi^2 = 4.566$	$p > 0.05$
One to three years	94	9 (0.96)		
Greater than three years	262	48 (18.32)		
Sex				
Male	143	16 (11.1%)	$\chi^2 = 3.401$	$p < 0.05$
Female	241	44 (18.25%)		
Breed				
Local	238	37 (15.55)	$\chi^2 = 0.003$	$p > 0.05$
Cross	146	23 (15.75)		
Total	384	60 (15.63)		

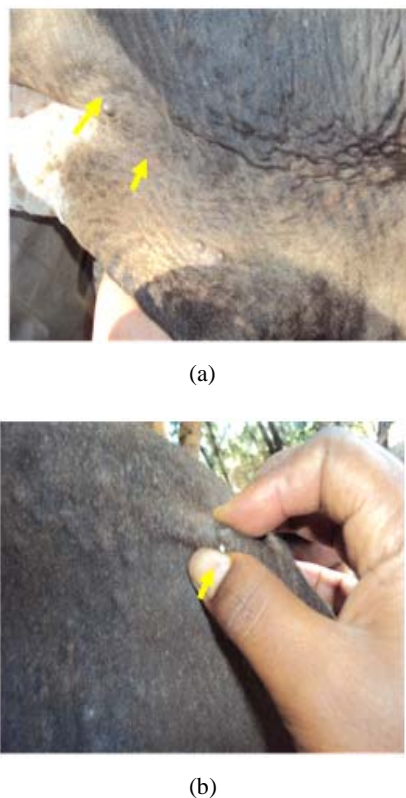


Fig. 1: Nodules containig white to creamy pus on the shoulder and dewlap of affected cattle.

Table 2: Spatial distribution of bovine demodicosis on the body of examined animals.

Site of infestation	Number of cattle examined positive (%)	Chi-square	p-value
Shoulder	31 (8.08 %)	$\chi^2 = 384$	$p < 0.05$
Neckl	7 (4.43 %)		
Back	1 (0.26%)		
Dew lap	2 (0.52%)		
Ear and eyes	4 (1.04%)		
Hind limb	3 (0.78 %)		
Fore limb	1 (0.26 %)		
Generalized	1 (0.26 %)		
Ribs	2 (0.52%)		
Total	60 (15.63 %)		

Table 3: Prevalence of bovine demodicosis based on management systems

Management	Number of cattle examined	Number of cattle found positive (%)	Chi-square	p-value
Semi-intensive	161	22 (13.66)	$\chi^2 = 0.051$	$p > 0.05$
Extensive	283	38 (13.43%)		
Total	384	60 (15.63%)		

There was also a statistically significant variation detected among the sites of infestation ($\chi^2 = 384$, $p < 0.05$) (Table 2). However, the highest prevalence was observed

on shoulder 31 (8.08 %) and the lowest on forelimb and generalized lesions which was 0.26%.

There was statistically insignificant variation detected between the two management systems ($\chi^2 = 0.051$, $p > 0.05$) and relatively higher prevalence was observed on cattle from semi-intensive 22 (13.66%) than those from extensive 38 (13.43%) management system (Table 3).

DISCUSSION

Prevalence: The present study revealed that the overall prevalence of demodicosis in cattle was 15.63%. This result is higher than the previous studies which were conducted by Chalachew (2001), 1.63% in Wolayita Sodo, Yacob *et al.* (2008), 1.88% in Adama, Regasa (2003), 0.42% in Nekemte, Bogale (1991), 4.19% in Debre-Zeit, Eydal and Richter (2010), 1.8% in Iceland, Izdebska (2009), 1% in Poland and Yacob *et al.* (2008), 5.9%, in and around Mekelle. But it was lower than the previous study of Matthes and Bukva (1993) who reported 94% in Mongolia. The current study indicated that bovine demodecosis is one of the prevalent ectoparasites of cattle as compared with preveiuos mixed species studies. This might suggest that the study area was conducive for the survival, multiplication and development of *Demodex bovis*. This could also be associated with poor management with regard to housing, feeding, stress, poor health services and negligence about such diseases assuming that they are self regressible.

Demodex bovis was found 15.55% and 15.75% prevalent in local and cross breeds respectively. This finding was not in agreement with the previous work of Yacob *et al.* (2008) who reported lower prevalence of *D. bovis* in local breed (8.8%) and cross breeds (2.2%) in and around Mekelle. In addition, Yacob *et al.* (2008) reported a lower prevalence of *D. bovis* (0.00%) on cross breeds in Adama. This higher prevalence, 15.75%, on cross breed of cattle might be due to the fact that cross breeds are more susceptible than the local breeds to *D. bovis*. Since cross breed usually kept in and around urban areas while local breed of cattle are reared in rural areas; higher prevalence in theses site would likely to occure then in the rural area where farmers do not afford them and with this most of them were kept under free range grazing system.

Almost similar findings were also recorded in the two managemnet systems of cattle with regard to prevalence. These are 13.66 and 13.43% in managed under semi-intensive and extensive systems respectively. These were found lower than the results reported by Yacob *et al.* (2008) which accounts 23.7 and 76.2% for semi-intensive and extensive systems respectively. This difference might be due to a variation in climatic conditions, management and feed accessibility between the two study areas. Additionally, the lower prevalence on those managed

under extensive production system might be due to the larger number of sample size (283) than in those kept under semi-intensive production system (161).

Demodex bovis was also found varied according to sex of animals. Therefore, the prevalence of demodicosis was 11.2% in male and 18.26% in female. But this report disagree with the previous work of Yacob *et al.* (2008) who reported 2.22% in male and 1.67% in female animals respectively in Adama and the report of Bogale (1991) who indicated 4.57 and 3.17% in male and female animals in Debre Zeit respectively. This might be associated with physiological stress condition during pregnancy and lactation, the lesser emphasis given by owners on feeding of female animal with regard to better feeding habit of owners in feeding of male animals since they used for ploughing, fattening and higher financial gain at the market level.

Age of animals was also another point which appears as a risk factor for the occurrence and different prevalent rates recorded on animals. Based on the present finding, the prevalences of *D. bovis* were 10.71, 0.96 and 18.32% for less than one year, one to three years and greater than three years of age respectively. This was higher than the previous work done by Yacob *et al.* (2008) who stated 1.06 and 2.04% prevalence in young and adult cattle respectively and with the work of Bogale (1991) who reported 7.95% in young 2.40% adult in Debre Zeit. This indicated that demodicosis was occurred in all age groups with various intensity. The result might be due to the fact that organism living as a commensal like demodicosis could suddenly become a pathogen by its rapid unpredicted multiplication; immunodeficiency of the host and complicity with other pathogens (Radostits *et al.*, 2007).

The spatial distribution of cattle demodicosis on the body parts revealed that *D. bovis* was 8.08 % on the shoulder region followed by neck (4.43%), hind limb (0.78%), dew lap (0.52%), ear and eyes (1.04%), ribs (0.52 %), back (0.26 %), forelimb (0.26 %) and generalized (0.26 %). Similar body location and infestation were reported by Kahn and Marry (2005) in, Ademe *et al.* (2006), Schulz *et al.* (1968) and Bukva *et al.* (1985). Kahn and Marry (2005) and Ademe *et al.* (2006). Furthermore, Schulz *et al.* (1968) and Bukva *et al.* (1985) in Czechoslovakia stated that the distribution of nodules of *D. bovis* on the host's body has typical pattern where the predilection sites were the shoulder, brisket, neck and the adjoining body part. Therefore, the most frequently affected sites were shoulder and neck while the less frequently affected were the forelimb and back. This indicated that *D. bovis* requires less hairy area and it was responsible for high loss of skin and hide since its infestation was on important parts of the body for making leather. The higher exposure of shoulder and neck regions could be due to their purpose for yoke pad and easiness

for the animal to rub the affected part with permanent objects to avoid itching which might lead to self-infliction and might facilitate the infestation, progress and spread to other parts.

Clinical, histopathologic and tannery examinations:

The incidence of demodectic mange among the total number of cattle surveyed (384) was 15.63%. The disease was observed among animals in good conditions as well as among emaciated ones. Hide and meibomian gland lesions of demodectic mange were simultaneously seen in infected cattle. Eye affection with demodectic mange was only observed in cattle with hide lesions of the disease and was never encountered among cattle showing no hide lesions, but eye affection was not observed in all cattle than had hide lesions of the disease. In this respect, farther inspection of the eyes of the cattle surveyed (112) revealed varying degrees of swelling of the eyelids and lacrimation in 49 cattle (12.76%). Different forms of hide lesions of demodectic mange were encountered: papules, nodules, pustules (Fig. 1) and crust-like lesions. These lesions were found confined to certain parts of the body or were generalized involving the whole body. The disease caused pruritis manifested by the animals licking or rubbing their body against objects. The meibomian gland lesions caused varying degrees of swelling of the eyelids and lacrimation. The mucous membranes were hyperaemic and congested.

Examination of the caseated and mucopurulent material expelled from the lesions of demodectic mange revealed numerous mites. Mites isolated from hide lesions were identified as *Demodex bovis*.

In the light of the findings obtained from the survey, laboratory investigations and histopathology. A severe granulomatous reaction was demonstrated and was suggestive of a progressive disease and was reminiscent of a delayed hypersensitive reaction of the tubercular in type. Infiltrated white blood cells around the parasite in the tissue were eosinophils.

In the tannery, hides were un-haired and demodectic lesion was easily detected and direct examination of semi and processed hides large nodules were prominent. Enlarged openings on the grain surface were observed which was caused by scabbing demodectic lesions. Through light nodules were seen as dark spots in different levels (some were near the grain surface and some other were deep in the thickness). The larger sized nodules were found destroyed large part of the hide. The numbers of lesion per hide range from 21 to 780 with common site of infection were the shoulder and eyes and ears. The amount of damage in the leather owing to demodicosis depends on the severity of the disease. The common defects on the leather were pinhole, slight depressions or voids in split leather, eroded and ragged areas and rough grain surfaces.

CONCLUSION

D. bovis mites were found to be nesilient diseases in cattle. The prevalence was higher indicating the wide spread nature of the diseases. This also implied that the mite (*Demodex bovis*) is economically important for its being hide damaging nature and thus found economically significant. Animals usually showed this diseases in cases where they have been immunocompromised.

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